

## CLAIMS

I claim:

1. A relief plate for printing an image, said image including an area to be printed solid, the plate including in the area to be printed solid a set of line pattern perforations designed to not carry ink on the plate.
2. A plate as recited in claim 1, wherein the plate is a flexographic plate.
3. A relief plate as recited in claim 1, wherein the line pattern perforations include at least one of the set of patterns consisting of a line screen pattern, a jagged line pattern, a wavy line pattern, a line pattern wherein the lines are not of constant thickness, a cross-hatch pattern, and a periodic pattern of circular lines.
4. A relief plate as recited in claim 1, wherein the line pattern perforations form a stochastic pattern.
5. A relief plate as recited in claim 1, wherein the line pattern perforations form a periodic pattern at a frequency in at least one direction of at least 200 per inch.
6. A relief plate as recited in claim 1, wherein the plate includes at least one non-solid rendition area screened with a halftone screen at a halftone screen angle, wherein the line pattern perforations are substantially in a pattern direction, and wherein the pattern direction is between 20 and 70 degrees to the printing direction.
7. A relief plate as recited in claim 6, wherein the pattern direction is approximately 45 degrees to the printing direction.
8. A relief plate as recited in claim 1, wherein thickness of lines in the line pattern perforations is selected such when the plate is inked and a reproduction is made, the lines in the reproduction almost fully but not necessarily completely fill in.
9. A relief plate as recited in claim 1, wherein the plate includes at least one non-solid rendition area screened with a halftone screen having a screen frequency, and wherein the line pattern perforations form a periodic pattern at a frequency an integer multiple of the screen frequency.

10. A relief plate as recited in claim 1, wherein the plate includes a least one non-solid rendition area screened with a halftone screen having a screen pattern that has a supercell structure defined by a first set of supercell parameters, and wherein the line pattern perforations form a periodic pattern according to a second set of supercell parameters that have a rational relationship to the first set of supercell parameters, the rational relationship defined by two integer values parameters.
11. A relief plate as recited in claim 1, wherein the plate includes at least one non-solid rendition area screened with a halftone screen, including at least one area for reproduction at a corresponding gray-level above a threshold gray-level, and wherein the perforations are included in at least some of the non-solid areas for reproduction at corresponding gray-levels above said threshold gray-level.
12. A relief plate as recited in claim 11, wherein the plate includes perforations in non-solid rendition areas such that the nature of the perforations is related to the local gray-level to provide a smooth transition from the threshold gray-level using the main screen with no perforations to the areas for solid rendition including the perforations.
13. A plate for relief printing of an image by transfer of ink to relief regions on the plate using an inking system, the plate including:
  - at least one area to be reproduced as a solid region in a reproduction
  - wherein the area of the plate for solid region reproduction includes a set of relatively thin grooves intended to not receive ink by the inking system.
14. A plate as recited in claim 13, wherein the grooves have a thickness of between 5 and 60 micrometer.
15. A plate as recited in claim 14, wherein the grooves have a thickness of between 10 and 50 micrometer.
16. A plate as recited in claim 13, wherein the plate is a flexographic plate.
17. A plate as recited in claim 13, wherein the set of grooves forms at least one of the set of patterns consisting of a line screen pattern, a jagged line pattern, a wavy line pattern, a line

pattern wherein the lines are not of constant thickness, a cross-hatch pattern, and a periodic pattern of circular lines.

18. A plate as recited in claim 13, wherein the set of grooves forms a stochastic dot pattern.
19. A plate as recited in claim 13, wherein the set of grooves forms a periodic pattern at a frequency in at least one direction of at least 200 per inch.
20. A plate as recited in claim 13, wherein the plate includes a least one non-solid rendition area screened with a halftone screen at a halftone screen angle, wherein the set of grooves forms a pattern substantially in a pattern direction, and wherein the pattern direction is between 20 and 70 degrees to the printing direction.
21. A plate as recited in claim 20, wherein the pattern direction is approximately 45 degrees to the printing direction.
22. A plate as recited in claim 13, wherein thickness of the grooves is selected such when a reproduction is made, the lines in the reproduction corresponding to the grooves almost fully but not necessarily completely fill in.
23. A plate as recited in claim 13, wherein the plate includes a least one non-solid rendition area screened with a halftone screen having a screen frequency, and wherein the set of grooves forms a periodic pattern at a frequency an integer multiple of the screen frequency.
24. A platemaking master for producing a relief plate, said plate including at least one area intended for reproducing a minimum non-zero gray-level using a first halftone pattern of dots, said platemaking master providing exposure in the well-regions between the halftone dots of said area in an area corresponding to said plate area, such that the wells in the plate are shallower than if no exposure is provided, thereby providing for smaller halftone dots than if no exposure is provided in the well regions of said at least one area.
25. A platemaking master as recited in claim 24, wherein the plate is a flexographic plate.

26. A platemaking master as recited in claim 24, wherein the platemaking master is a film or carbon layer for making the plate.
27. A platemaking master as recited in claim 24, wherein the platemaking master is a digital master.
28. A platemaking master as recited in claim 24, wherein the exposure is provided by one or more transparent dots in the well regions designed to be non-printing.
29. A platemaking master as recited in claim 28, wherein the dots in the well regions form a stochastic pattern.
30. A platemaking master as recited in claim 24, wherein each well includes a protective region around any printable halftone where no exposure is provided.
31. A platemaking master as recited in claim 24, wherein said platemaking master comprises:
  - printable halftone dots in said corresponding area to produce said halftone pattern of dots; and
  - small dots in the well regions between printable halftone dots of said corresponding area, said small dots being to provide the exposure in the well regions,
  - the size or sizes of the small dots selected to ensure that the small dots do not print in said area of the plate.
32. A platemaking master as recited in claim 31, wherein the small dots are significantly smaller than the printable halftone dots.
33. A platemaking master as recited in claim 31, wherein the plate includes one or more other areas, each of a gray-level that is higher than the minimum gray-level reproduced by said area, wherein such other areas of gray-levels higher than the minimum non-zero gray-level are produced using a halftone screen, and wherein said halftone pattern of dots forms a halftone screen with same frequency and angle as the screen used for higher gray-levels.
34. A platemaking master as recited in claim 31, wherein the small dots form a stochastic pattern.

35. A platemaking master as recited in claim 31, wherein the plate includes a first set of one or more areas each for reproducing a gray-level that is higher than the minimum gray-level and less than a threshold gray-level, wherein the plate further includes a second set of one or more areas each for reproducing a gray-level that is higher than the threshold gray-level, wherein for reproducing a gray-level between the minimum gray-level and the threshold gray-level, the number of printable dots per unit area varies according to the gray-level, and wherein for reproducing a gray-level higher than the threshold gray-level, the size of the printable dots varies according to the gray-level.
36. A platemaking master as recited in claim 35, wherein, in an area for reproducing a gray-level between the minimum gray-level and the threshold gray-level, the printable dots are not necessarily in the same location as corresponding printable dots in an area for reproducing a gray-level higher than the threshold gray-level.
37. A platemaking master as recited in claim 24, said plate including an area to be printed solid, the master comprising in the master's corresponding area to be printed solid a set of line patterns, such that the plate includes in the area to be printed solid a set of line pattern perforations designed to not carry ink.
38. A relief plate as recited in claim 37, wherein thickness of lines in the line pattern perforations is selected such when the plate is inked and a reproduction is made, the lines in the reproduction almost fully but not necessarily completely fill in.
39. A platemaking master intended for producing a flexographic plate, said master comprising:  
  
dots arranged along a screening pattern,  
  
said dots including a first set of dots that are printable and a second set of dots that are non-printable, the second set being empty in areas for reproducing gray-levels above a threshold gray-level.
40. A platemaking master as recited in claim 39, wherein for gray-levels below said threshold, the number of dots per unit area in the first set increases with gray-level such that the number of non printable dots per unit area in the second set decreases.

41. A platemaking master as recited in claim 40, wherein for gray-levels above said threshold, the size of the printable dots increases with gray-level.
42. A platemaking master as recited in claim 39, wherein the dots form a stochastic pattern.
43. A flexographic plate having a shallow depth of wells between halftone dots in highlight areas, said shallow areas caused providing exposure in the well regions of the highlights by using a platemaking master to create said plate, said platemaking master providing exposure in the well regions in the highlight regions.
44. A flexographic plate as recited in claim 16, wherein said platemaking master includes transmittive patterns in the well regions of the highlight areas to provide the exposure to the well regions.
45. A flexographic plate as recited in claim 44, wherein said transmittive patterns are in the form of holes in the well regions of the highlight areas, said holes selected to be non-printing dots in the plate.
46. A flexographic plate as recited in claim 45, wherein the holes form a stochastic pattern in the well regions of the highlight areas.
47. A flexographic plate as recited in claim 44, wherein each well includes a protective region around any printable holes where no exposure is provided.
48. A screening method creating a combination screen pattern on a relief plate or platemaking master for a relief plate, such that highlight areas have additional dots in the well regions designed to be non-printing on the plate.
49. A screening method as recited in claim 48, wherein the number of additional dots decreases with increasing gray-level in the highlight region.
50. A screening method as recited in claim 48, such that halftone dots in shadow areas include line pattern perforations and further such that areas for solid rendition include line pattern perforations.

51. A screening method creating a combination screen pattern on a relief plate or platemaking master for a relief plate, such that halftone dots in shadow areas include line pattern perforations and further such that areas for solid rendition include line pattern perforations.
52. A screening method as recited in claim 51, wherein the number of perforations decreases with decreasing gray-level in the shadow regions.
53. A screening method as recited in claim 51, wherein the thickness of the perforations decreases with decreasing gray-level in the shadow regions.
54. A screening method as recited in claim 51, such that highlight areas have additional dots in the well regions designed to be non-printing on the plate.
55. A threshold array for screening, the threshold array, when thresholded against a low gray-level produces a stochastic screen with dots not all equal in size, including small dots, and produces when thresholded against a medium gray-level a conventional screen according to a frequency, angle and dot shape definition,  
  
said small dots providing for creating shallower wells in a relief plate between halftone dots than if said small dots are not included.
56. A threshold array for screening, the threshold array such that, when thresholded against maximum gray scale produces a pattern of perforations.
57. A method of making a platemaking master for making a relief plate that includes perforations, the method including:
  - (a) providing an original threshold array for screening an image to be printed;
  - (b) selecting the nature, number and position of perforations to be included in a relief plate;
  - (c) generating a modified threshold array by setting each matrix element in the original threshold array that corresponds to a perforation to a predetermined value that ensures that the element is prevented from being set OFF when used for halftoning, regardless of the density value of the image to be printed; and

- (d) using the modified threshold array in place of the original threshold array to produce a platemaking master for a relief plate for printing the image,
- the modified threshold array being such that when thresholded against the maximum gray-level produces a pattern of perforations in the platemaking master.
58. A screening method using a set of bitmaps, one bitmap per gray-level, the screening method determining the halftone screen for a part of an image according to the bitmap corresponding to the gray-level of the part, such that the bitmap for a first gray-level includes dots of a first kind that are ON in a first position where the bitmap of a second gray-level higher than the first gray-level has no dots ON of the first kind, said dots of a first kind intended to be not printable and intended for providing additional exposure in the well regions between printable halftone dots in the bitmap of the first gray-level.
59. A method of printing a reproduction of an image comprising:
- (a) determining a non-100 % density that prints darker than the full solid, said non-100% density produced by a pattern that includes perforations;
  - (b) mapping the highest gray-value in the image to the determined non-100 % density;
  - (c) mapping gray values in the image less than the highest gray-value to densities lower than the determined non-100 % density; and
  - (d) creating a relief plate from the densities to which the image was mapped, the relief plate usable for making the reproduction of the image,
- such that the in areas for 100% density, the relief plate includes grooves.
60. A platemaking master for making a flexographic plate, the master providing exposure in the well regions between printable half-tone dots of highlight areas such that the wells are shallower than if no exposure is provided for the well regions, thereby providing for smaller halftone dots than if no exposure is provided in the well regions of highlight areas.
61. A platemaking master as recited in claim 60, wherein the providing the exposure in the well regions between half-tone dots of highlight areas in a manner that includes avoiding exposure in a guard interval around each printable halftone dot.



62. A platemaking master as recited in claim 60, wherein for areas that are to be reproduced for a shade of gray below a first pre-determined threshold, modulating the tone levels includes varying the number of printing dots per unit area.
63. A platemaking master as recited in claim 62, wherein for areas that are to be reproduced for shades of gray significantly higher than the threshold, the master includes a main screen having a plurality of halftone dots centered on an array that provides a desired screen frequency at a desired screen angle.
64. A platemaking master as recited in claim 63, wherein the threshold below which modulating the tone levels includes varying the number of printing dots per unit area is the shade of gray of the main screen with halftone dots of a first selected size, and wherein the screen is generated by a method that includes providing exposure in the well regions between half-tone dots in the areas that are to be reproduced for shades of gray below the first pre-determined threshold such that the wells are shallower than if no exposure is provided for such well regions.
65. A platemaking master as recited in claim 64, wherein the printable halftone dots in areas that are to be reproduced for shades of gray below a first pre-determined threshold are positioned so that at least some of the dots are not centered on points of the array of the main screen.
66. A method of producing a platemaking master for making a relief plate, the method comprising:
  - generating a first bitmap of a source image using a first screening method using a first screen pattern;
  - generating a second bitmap of the source image; and
  - combining the first bitmap with the second bitmap,
 wherein the second bitmap includes one of the set of two patterns consisting of:
  - an additional exposure pattern to provide additional exposure for the well regions of the first screen pattern in the highlight areas of the source image, and

a perforations pattern to provide perforations in the shadow areas or solid areas of the source image.

67. A method as recited in claim 66, wherein in the case the second bitmap includes the additional exposure pattern, the additional exposure pattern is a screening designed not to create moiré with the first screen pattern.
68. A method as recited in claim 66, wherein in the case the second bitmap includes the additional exposure pattern, the additional exposure pattern is a stochastic pattern.
69. A method as recited in claim 66, wherein in the case the second bitmap includes the additional exposure pattern, the combining includes ensuring that no pixels are switched ON in the combined bitmap within a first neighborhood of any pixel that is ON in the first bitmap.
70. A method as recited in claim 66, wherein the method is implemented on a processing system.
71. A method as recited in claim 66, further comprising:  
generating a third bitmap including the pattern not included in the second bitmap,  
wherein the combining further includes combining the third bitmap to provide a bitmap of the combination of the first, second and third bitmaps.
72. A screening method for producing a platemaking master, the master for producing a relief plate, said method including:  
using a first halftone pattern of dots for reproducing a minimum non-zero gray-level;  
and  
providing exposure in the well-regions between the halftone dots in any area in the platemaking master for reproducing said minimum gray-level,  
such that the wells in the resulting plate made using the platemaking master are shallower in the corresponding area of said minimum gray-level than if no exposure is provided,

the screening method thereby providing for smaller halftone dots than if no exposure is provided in the well regions of any minimum gray-level area.

73. A screening method as recited in claim 72, wherein the plate is a flexographic plate.
74. A screening method as recited in claim 72, wherein the platemaking master is a film or carbon layer for making the plate.
75. A screening method as recited in claim 72, wherein the platemaking master is a digital master.
76. A screening method as recited in claim 72, wherein the exposure is provided by one or more transparent dots in the well regions designed to be non-printing.
77. A screening method as recited in claim 76, wherein the dots in the well regions form a stochastic pattern.
78. A screening method as recited in claim 72, wherein each well includes a protective region around any printable halftone where no exposure is provided.
79. A screening method as recited in claim 72, wherein said platemaking master comprises:
  - printable halftone dots in said corresponding area to produce said halftone pattern of dots; and
  - small dots in the well regions between printable halftone dots of said corresponding area, said small dots being to provide the exposure in the well regions, the size or sizes of the small dots selected to ensure that the small dots do not print in said area of the plate.
80. A screening method as recited in claim 79, wherein the small dots are significantly smaller than the printable halftone dots.
81. A screening method as recited in claim 79, wherein the small dots form a stochastic pattern.
82. A screening method as recited in claim 72, further including:

including a set of line pattern perforations for reproducing a solid area, such that the plate includes in the area to be printed solid a set of line pattern perforations designed to not carry ink.

83. A screening method as recited in claim 82, wherein thickness of lines in the line pattern perforations is selected such when the plate is inked and a reproduction is made, the lines in the reproduction almost fully but not necessarily completely fill in.

84. A method of generating a device color profile for a relief printing process, the method comprising:

printing a set of patches using said printing process using a plurality of inks printed at different gray-levels, the printing using a relief plate for each ink made from a corresponding platemaking master, each master for each ink including:

for any patch for reproducing a minimum non-zero gray-level of the ink, a halftone pattern of dots; and

for any patch for reproducing a maximum-level of the ink, a set of line pattern perforations, such that the plate includes in the area to be printed solid with the color, a set of line pattern perforations designed to not carry ink;

measuring the color of each patch; and

generating a color device profile for the printing process for use in a color management system,

such that the color profile is usable for generating color separations for the printing process or for a color proofing process for the printing process.

85. A method as recited in claim 84, wherein each master for each ink provides exposure in the well-regions between the halftone dots in any area in the platemaking master for reproducing said minimum gray-level, such that the wells in the resulting plate made using the platemaking master are shallower in the corresponding area of said minimum gray-level than if no exposure is provided.

86. A method as recited in claim 84, wherein the printing process is a flexographic process.
87. A method of generating a device color profile for a relief printing process, the method comprising:
- printing a set of patches using said printing process using a plurality of inks printed at different gray-levels, the printing using a relief plate for each ink made from a corresponding platemaking master, each master for each ink including:
    - for any patch for reproducing a maximum-level of the ink, a screened pattern;
    - measuring the color of each patch; and
    - generating a color device profile for the printing process for use in a color management system,
  - such that the color profile is usable for generating color separations for the printing process or for a color proofing process for the printing process.
88. A method as recited in claim 87, wherein each master for each ink further includes, for any patch for reproducing a minimum non-zero gray-level of the ink, a halftone pattern of dots, and wherein each master for each ink provides exposure in the well-regions between the halftone dots in any area in the platemaking master for reproducing said minimum gray-level, such that the wells in the resulting plate made using the platemaking master are shallower in the corresponding area of said minimum gray-level than if no exposure is provided.
89. A method as recited in claim 87, wherein the screened pattern used for the maximum-level of the ink is the screening percentage that produces the highest density print.
90. A method as recited in claim 87, wherein the screened pattern used for the maximum-level of the ink is a screen of at least 90% coverage.
91. A method as recited in claim 87, wherein the screened pattern used for the maximum-level of the ink has a coverage percentage higher than for all gray-levels of the ink less than the maximum.

92. A method as recited in claim 87, wherein the printing process is a flexographic printing process.